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(54) Title: MUSIC LISTENING SYSTEM

(57) Abstract: A music listening system as many found in a music retail store is disclosed having a music listening station allowing multiple uses to listen to respective music selected by them. The music listening system has a means for storing a large volume of music in a memory and compiling an index to assist in the selection process.

MUSIC LISTENING SYSTEM

The present invention relates to equipment for enabling a customer to listen to music which he/she may wish to purchase, for example a customer in a music retail store. More specifically, though not exclusively, the invention relates to a music listening station which enables customers to select, from a vast library of music tracks, tracks which they wish to listen to prior to deciding whether to make a purchase.

It is known to provide music listening posts in, for example, music retail stores. Such posts commonly consist of a set of headphones which are connected to the output of a CD player, which for convenience and security is normally located at a separate location in the store. At some listening posts it is possible for the customer to select from a predetermined small selection of albums (usually no more than four or five) one album of music

which he/she wishes to listen to, and to skip forward/back through the various tracks in the album in order to sample the individual tracks. Such a system is based on a CD player system having a multi-CD drive facility i.e. all the CD albums available for selection are physically held in the CD drive of the player system to which the listening point headphones are connected.

One problem of such systems is that only one customer at a time can control the CD player so as to access the selection of CDs and choose a desired CD. Even if more than one set of headphones can be connected to the CD player, each user must listen to the same selected CD. A further significant problem is that only a few CDs are available for the customer to select from at any one time, the number of CD albums available for selection being limited by the number of CDs which the player unit can hold in its drive. Typically, this is limited to 10 Cds available for preview from each "listening post".

Another disadvantage of such prior systems is that the CD changeover time is extremely slow, being typically approximately 10 seconds. Also, each CD player must be stocked with standard stock CDs which generally cannot be sold thereafter to the buying public. Moreover, the player has only limited capability to store

supplementary information such as artist information etc, and permit simultaneous display of such information whilst playing a CD.

It is an aim of the present invention to substantially avoid or minimise one or more of the foregoing disadvantages.

According to one aspect of the present invention there is provided a music listening system comprising music index compilation means for compiling index means for a library of music tracks for storage together with said library of music tracks on a distributable music storage means for use with the listening system; and a music listening station comprising:
memory means for storing a library of music tracks;
loading means for loading said library of music tracks and said index means from the distributable music storage means into said memory means;
selection means for enabling at least one user to select from said index means stored in said memory means a particular music track which he/she wishes to listen to; and playback means for enabling at least one user to listen to a said music track which he/she selected.

By storing the library of music tracks in a memory means, the number of tracks which can be selected by the user is only limited by the size of the memory means.

The selection means may conveniently comprise microprocessor means for controlling access to the music tracks stored in said memory means, and user input means via which a user may select desired tracks. The index means preferably comprises a list of albums, each album comprising one or more music tracks, and for each album a sub-list of the tracks thereof, and the user input means is conveniently configured to enable a user to select a track by first selecting, from the album list, the album containing the track and then selecting the said track from the respective track sub-list for that album.

Preferably, the user input means comprises first user input means for enabling a first user to select from said library of music tracks stored in said memory means a particular music track which he/she wishes to listen to, and second user input means for enabling a second user to select from said library of music tracks stored in said memory means a particular music track which he/she wishes to listen to. Further such user input means may additionally be provided for enabling more than two users to use the listening station at any time. Each said user

input means is preferably in the form of an electronic keypad means which is in communication with the microprocessor means, for enabling a user to select a desired music track. Alternatively, one or more said user input means may be in the form of bar code scanning means for enabling a user to select music by scanning a CD barcode, and the system further includes a database or look-up table from which music corresponding to the scanned barcode is identified and accessed by the microprocessor means.

Preferably, the playback means comprises means for streaming music tracks simultaneously to first and second headphone output means provided in the listening station. The music tracks being streamed simultaneously to said first and second headphone output means need not be the same music tracks and in fact in most cases they will not be the same as different users are unlikely to simultaneously select the same tracks for listening to.

The music tracks are preferably stored on said distributable music storage means, and in said memory means of the music listening station, in compressed form. For example the music tracks may be compressed in MPEG Layer III (often referred to as "MP3") format. The playback means preferably further includes a plurality of

decoder means for simultaneously decoding a plurality of streams of the compressed music data respectively. The compressed music may additionally be encrypted prior to storage on said music storage means, in which case the playback means further includes decryption means for decrypting the encrypted data. The decoder means may incorporate said decryption means. Alternatively, a multistage process may be employed whereby encrypted music files are decrypted (for example, using appropriate decryption software) to an intermediate compressed digital audio format and then decompressed in a hardware based decompression chip (for example a DSP processor) forming the decoder means.

It will be appreciated that by storing the music in compressed form, the available size of memory means can be used more efficiently i.e. so as to store a greater number of tracks.

Said plurality of decoder means are preferably connected to a parallel output port of said microprocessor means, whereby each said decoder means receives a serial stream of compressed music data from said playback means. Alternatively, said plurality of decoder means may be connected to said microprocessor means via another type of communication bus, for example via a PCI or USB bus,

but in such cases data serialising means is preferably provided for supplying the compressed music data to each decoder means in serial e.g. the serialising means may conveniently be an external USB controller where the compressed data is sent to the plurality of decoder means via a USB.

Preferably the memory means, the loading means and the microprocessor means are provided together in a single unit and each said user input means which is provided comprises a separate module which is connected to said unit. Said first and second headphone output means are most conveniently provided in said first and second user input means respectively, and are formed and arranged for connection to respective user headphone means for enabling first and second users respectively to listen to music streamed to said headphone output means.

Each said user input means is preferably connected to said unit via a single electrical communication cable via which audio signals are sent from said unit to the respective headphone output means provided in said user input means, and via which communication signals are sent from said user input means to said unit. These communication signals may, for example, include signals representing music tracks selected by a user. The single

electrical communication cable is preferably a standard LAN cable i.e. having four twisted pairs of wires. Preferably, all digital communication signals sent between the user input means and said unit of the listening station are sent via one twisted pair of wires in the LAN cable, while all analogue audio signals are sent to the headphone output means in the user input means via different twisted pairs in the LAN cable. In this manner, cross talk is minimised. To further reduce electrical cross talk it is further recognised that separate ground return lines could be provided for the analogue and digital signal paths between the listening station and the user input means. The isolation of analogue and digital sections prevents communications cross talk in the analogue (audio) channels.

The music index compilation means preferably comprises computer program means, for use in a computer system, the computer program means comprising computer readable program code for compiling index means for use in accessing a plurality of music tracks to be stored in the memory means of the listening station, the index means comprising a list of allocated codenames and for each said codename corresponding access information for accessing at least one file containing a said music track.

In one possible embodiment, the index means may comprise a list of allocated codenames associated with respective music tracks and, for each said codename, a filename of a file containing the respective music track. Thus, the computer readable program code may comprise code for compiling an index of music tracks to be stored in a directory of the memory means of the listening station, said index comprising a list of allocated code names for respective music tracks and for each said allocated code name a corresponding filename of a file which will contain the respective music, in use of the listening station. The index means may also list associated title data for each track filename, said title data being for display to a user when the music track stored under said filename is being played.

In an alternative embodiment, the computer readable program code may comprise code for:

a) compiling an index of albums of music tracks to be stored in a directory of the memory means of the listening station, said album index comprising a list of allocated album code names and for each said allocated code name a corresponding sub-directory name for accessing a sub-directory of said directory of said memory means which sub-directory will contain the album

having the said allocated code name, in use of the listening station;

b) compiling an index of tracks for each said album to be stored in the memory means, said track index comprising a list of track names and for each said track name a corresponding file name of a file which will be stored in the sub-directory which contains the album including the track having the said track name; and

c) compiling a configuration file comprising a structured list of all said album sub-directories listed according to sub-directory name, and of all said files named in the track indexes, each said file being listed in the respective album sub-directory.

The computer readable program code preferably further includes code means for enabling a user to interact with said computer program means so as to allow the user to control the order in which albums and/or tracks are listed in one or more of: the album index, the track indexes, and the configuration file, and/or to choose the sub-directory names and/or file names under which said albums and tracks are stored.

The computer readable program code preferably further includes code for compiling a file representing a CD-ROM image of a distribution CD which is to be created, said

CD-ROM image comprising a copy of the index means, a copy of all the files containing said music tracks, and a copy of the configuration file (where provided). This file is used in the creation of the distributable music storage means, which is preferably a CD-ROM, for use with the listening system.

The loading means of a listening station is preferably adapted to load said music tracks into the memory means of the listening station, from said distributable music storage means, so that they are stored in said memory means according to the file structure specified in the configuration file.

The above-described listening system may be used in a network system, for example a network system incorporating more than one said listening station, all the listening stations being controlled by control server means forming part of the network system. The control server means may be adapted to receive music files from a remote database with which the control server means is in communication, for example as a download from the internet, and to supply the received music files to one or more of the listening stations networked thereto.

According to another aspect of the invention there is provided music index compilation means for compiling index means for a library of music tracks for storage, together with said library of music tracks, on a distributable music storage means, said compilation means comprising computer program product means, for use in computer system, to compile said index means, the index means comprising a list of allocated codenames and for each said codename corresponding access information for accessing at least one file ccntaining a said music track.

The computer program product may comprise computer readable code means for:

a) compiling an index of albums of music tracks to be stored in a directory of a memory means, said album index comprising a list of allocated album code names and for each said allocated code name a corresponding sub-directory name for accessing a sub-directory of said directory of the memory means which sub-directory will contain the album having the said allocated code name;

b) compiling an index of tracks for each said album to be stored in the memory means, said track index comprising a list of track names and for each said track name a corresponding file name of a file stored in the sub-

directory which contains the album including the track having the said track name; and

c) compiling a configuration file comprising a structured list of all said album sub-directories listed according to sub-directory name, and of all said files named in the track indexes, each said file name being listed in the respective album sub-directory.

Preferably, said computer readable code means further includes code for compiling a file representing a CD-ROM image of a distribution CD which is to be created, said CD-ROM image comprising a copy of said index means, said configuration file, and a copy of all the files containing said music tracks.

Preferred embodiments of the invention will now be described, by way of example only, and with reference to the accompanying drawings in which:

Fig. 1 illustrates a dual channel digital listening station intended for in-store music listening via headphones, according to one preferred embodiment of the invention;

Fig.2 shows a window for display on a computer screen;

Fig.3 shows an album selection dialogue box;

Fig.4 shows a track selection dialogue box;

Fig.5 shows a track name dialogue box;

Fig.6 sows a window displaying the contents of a main configuration file;

Fig.7 is a window showing a file structure in a Windows operating environment;

Fig.8 is a flow diagram illustrating the steps performed by application software for use in compiling a distribution CD;

Fig.9 is a block diagram of the listening station of Fig.1;

Fig.10 is a schematic diagram of one end of a LAN cable used in the listening station;

Fig.11 is a block diagram of components of a headset of the listening station;

Fig.12 is a block diagram of a multi-channel PCI interface to multiple decoders, for an alternative embodiment of the listening station;

Fig.13 is a block diagram of a multi-channel USB interface to multiple decoders, for a further alternative embodiment of the listening station; and

Fig.14 is a block diagram of a networked system incorporating multiple listening stations.

A listening station 1 comprises a host player unit 3 and two headset units 5,6 (hereinafter referred to as the two "headsets"). A set of user headphones 7,8 is connected

to an output a of each of the two headsets 5,6 respectively. The host player unit (hereinafter referred to as the "player") 3 uses digitally compressed music files which are supplied to the player via an upload CD-ROM (hereinafter referred to as the upload "CD") which is distributed for use with the listening station 1. As indicated in Fig. 1, the player 3 has a CD-ROM drive 9 via which digitally compressed music files on the upload CD (not shown) can be copied ("uploaded") into a memory provided in the player 3. In practice, the upload process happens automatically upon insertion of a new CD into the CD-ROM drive, as will be described in detail later.

The listening station is designed for simple and reliable operation in retail stores as a stand-alone device. The upload CD which is distributed for use with the listening station 1 is created using dedicated application software which we have designed for this purpose. A suitable copy control application, such as Blue Pig Digital Audio (BPDA) software, is used to provide an element of control over the compressed music files which are included on the upload CD. Control firmware provided in the player is configured so that only copies of albums and tracks which were created with the BPDA software will be recognised by the player 3. One method for achieving this is to provide firmware in each headset unit 5,6 which firmware

incorporates a specific customer key, for example an 8-bit key. This could be the private key of a public/private key encryption algorithm. Such a system would also allow licence control of, for example, compilation software provided for use with the listening station.

As an additional security measure, all the compressed files to be stored on the uplcad CD are stored in encrypted form thereon. Any appropriate form of encryption could be used, but in the present embodiment a public key/private key encryption algorithm is used to encrypt the compressed music files which are to be stored on the upload CD.

During power-on (i.e. boot up) of the listening station 1, with the upload CD installed in the CD-ROM drive 9, the player 3 automatically loads (i.e. copies) new albums (not already stored in the memory of the player 3) from the upload CD into said memory of the player unit 3 and adds these to an available play list from which a customer in the retail store can select tracks to listen to. Thus, all compressed music files held in the memory of the player 3 are held in encrypted form. No communications interfaces are provided in the player 3 which would allow the player 3 to be connected to other

PC-based equipment to permit the transfer of the encrypted files out of the player 3. This combination of using file encryption and absence of suitable communications interfaces to transfer the encrypted filed out of the player 3 provides a high level of data protection which is recognised as an important factor by the music industry.

Each music album (comprising a number of individual tracks) is allocated a unique 3-digit code via which the potential customers (hereinafter referred to as the users) can select the album via a keypad 10,11 on either one of the headsets 5,6. The album codes are allocated during creation of the upload CD and cannot be altered. A listing of the album codes and corresponding full album/track titles will be displayed to the customer, for example in printed form for shop display, or on a visual display screen or LCD display forming part of the listening system (for example an LCD display in the headset units 5,6). The two headsets 5,6 are independent, enabling two separate users to select and listen to different albums. Once an album is selected by a user the album title is displayed on an LCD display 13,14 on the respective headset 5,6 via which the user selected the album, and the album title is followed on the LCD display by the title of the track which is currently

being played to the user. Each album begins playing within one second of a valid album code being entered into one of the headsets.

As well as a numerical keypad 10,11 each headset 5,6 includes further control keys/buttons for enabling the user to select and control the music tracks he/she listens to. These further control keys 15,16 on each headset include the following:

track forward and track back keys - these select the next or previous track, respectively, from the chosen album;

album forward and album back keys - these select the next or previous album respectively, from the predetermined order of albums in the album index file stored in the memory of the player 3. The album forward/back keys may also be configured as FF/RR keys;

volume up and volume down keys - these change the headphone volume setting for the respective headset. The headsets are programmed to-

have twenty levels of volume control, this being recognised as sufficient for in-store use.

Each headset 5,6 incorporates three headphone outputs, two outputs *a,b* for allowing two headphone sets 7 to be installed per headset 5,6 (only one headphone set is shown connected to each headset 5,6 in Fig. 1). A third

one c of the three headphone outputs feeds a panel mounted stereo jack socket which can be used with any personal hi-fi headphone set (3.5mm stereo jack). Thus, the user can use his own personal hi-fi headphones if desired. The headset 5,6 itself is formed as a robust faceplate which can be mounted on any retail fixture (such as a stand or kiosk) using mounting screws.

The listening station is designed for ease of installation, utilising standard eight-way UTP cable and RJ45 connectors to connect the headsets to the player 3, as will be described in further detail later. Each headset 5,6 can be positioned up to ten metres away from the player 3 which is designed to require minimal operator involvement. The operator is required only to install the upload CD in the CD drive, firmware being provided in the player 3 to automatically copy compressed music from the upload CD to the memory of the player 3 (as above-described), so that no further operator involvement is required. In the present example, the firmware includes a boot.exe program which, when a new upload CD is inserted in the CD-ROM drive 9, is activated. The boot.exe program checks to see if a new CD-ROM has been entered (this is done by reading a date stamp or serial number on the upload CD) and, if it is a new CD, then copies the content of the CD to the player

memory. Status messages are provided on the LCD headset displays during boot-up and CD upload. Old music content stored in the player memory may, if desired, be removed prior to carrying out an upload from a new CD. Alternatively, partial updates may be possible, where some old content is retained in the player memory and new and/or amended content is added to the memory from the upload CD.

In a possible modified embodiment the player 3 may be provided with a multi CD-ROM drive thereby allowing CD uploads from multiple CDs to take place. As the player's hard disk memory will have a greater capacity than a single CD, this modification would allow updates which span several CDs to take place substantially simultaneously.

The application software provided in order to compile the upload CD for use with the listening station 1, will now be described in detail. The software is intended for use in a standard personal computer (PC) in which Microsoft Windows environment is installed. The software is designed to create a CD-ROM image of a distribution CD (the "upload CD") from which compressed music files will be uploaded (i.e. copied) to a non-volatile memory of the player 3 of the listening station 1. The listening

station 1 accesses the stored compressed music files from this non-volatile memory of the player 3. Each album of music tracks is stored in a separate sub-directory of the root directory, C, of the memory e.g. in C:/001 for album number 1, C:/002 for album number 2 etc. The player 3 requires the use of a number of configuration files to allow the albums and tracks to be selected on the headsets 5,6 by users. The function of the software which will now be described is to create all the necessary configuration files for the albums which have been selected to be included on the distribution CD. Once the configuration files are created, the application software will automatically generate an image of the distribution CD and store it in a user-defined directory in a host computer system in which the application software is running (e.g. C:/upload on the hard disk memory of the host computer system). This greatly simplifies the task of creating a CD-ROM image for the distribution CD. Copies of the actual CD albums (in digital compressed format, and encrypted) are present in a memory of the host computer system in which the software is running, or most preferably in the memory of a secure server system to which the host computer system is connected. The compressed and encrypted files are obtained by copying digital files from music CDs onto the host system's (hard disk) memory in an uncompressed WAV

format. The music files are then compressed and encrypted, using a combination of compression algorithm and encryption algorithm, and stored on the secure server.

We will now describe in detail the functions which the application software provides, in order to enable an album index configuration file, and a track index file for each album, a main configuration file, and a CD-ROM image file to be compiled. The application software is provided in the form of a .exe application which can be installed in a suitable folder on the Windows desktop of a personal computer (PC). It should be noted that the application software is not intended for running on the music listening station itself (although in some cases this may be possible). The application software can be run by selecting the relevant icon for the application from the Windows desktop of the PC. When the icon is selected, a main application window 20 will open as shown in Fig. 2 and the application automatically opens a new configuration window 21 (within the main application window 20) for creating a new configuration file for a new distribution CD. It is possible to edit an existing configuration file (extension.BPA), using the Windows File menu to open the required configuration file (in known manner).

To begin the addition of an album to the proposed new distribution CD, the operator (who is compiling the new configuration file using the software) selects the button 22 labelled "add" which is provided in the configuration file window 21 and an album selection dialogue box 25, as shown in Fig. 3, will then be automatically opened by the application software.

Album Index Configuration File

The compressed albums included in the upload CD are copied from the upload CD to a directory in the memory of the player 3 (e.g. C:/Albums), prior to use of the listening station by users. Each album is stored in a sub-directory of this directory C:/Albums. To allow the user of the music listening station to select albums via a 3-digit code entry on the headset keypad, as described above, the player 3 requires a configuration file which defines the sub-directory (of the memory of the player 3) which is associated with the selected album. This configuration file is called the album index file and is stored in the root directory of the distribution CD as /albumidx.txt. This is a standard text file which is opened by the player 3 and used as the pointer to album sub-directories.

The album index file is compiled by the operator using the album selection dialogue box 25 of Fig. 2, and by following the procedure outlined immediately herebelow:

Step 1: Select the chosen album using the Browse button 26 in the album selection dialogue box 25 - this will cause a list of the files contained in a sub-directory (named "Albums") of the root directory (C) of the host computer system in which the software is running to be displayed. Each of these files contains a compressed version of a CD album of music tracks. In the preferred embodiment of the invention, each album is in MP3 compressed format. By selecting a file in the albums sub-directory, this automatically enters the directory path in a directory field 26 in the album selection dialogue box 25.

Step 2: Enter a valid 3-digit code for the album, in the "Selection No." field 27 of the dialogue box 25, this code being between 000 and 999.

Step 3: Type in the album title in an album name field 28 provided in the album selection dialogue box 25. The album title can be up to twelve characters long and this will be the title displayed on the LCD display 13 of the listening station headsets, when tracks from this album are played back to a user.

The application software uses the above information entered by the operator in the album selection dialogue box to compile the album index file. The following lines are an extract from a typical album index file so compiled:

001Album1 001

002Album2 002

The first three characters on each line are the keypad selection number (i.e. the 3-digit code name for the album which will be entered by the user) and the following twelve characters are used for the album name to be displayed on the LCD screen 13 of the headsets. The final eight characters give the appropriate sub-directory name (e.g. 001 under which the relevant album is stored in the directory C:/Albums of the memory of the player 3) containing all the albums.

Track Index Files

Once the user selects an album using the keypad on one of the headsets 5,6 of the listening station, the first track of that album will begin playing. To achieve this the player 3 needs to know the name of each file (e.g. Track 1) stored in the album sub-directory (e.g. C:/Albums/Album 1) to allow the user to select tracks via

the next/previous track keys on the headset keypads. In addition, the player needs the track title to be displayed on the headset LCD display 13. To this end, a track index file is created for each album and this file is stored in that album's sub-directory, along with the compressed version of the album. The track configuration file is named trackidx.txt, for each album. The track index file for each album is compiled by the operator, via the album selection dialogue box 25 of Fig. 3, in the following manner (following on from steps 1, 2 & 3 above):

Step 4: Select any or all of the tracks from the album by using the track selection button 29 in the dialogue box 25. This opens the track selection dialogue box 30 shown in Fig. 4.

Step 5: Using backwards and forwards arrow buttons 31,32 provided in the track selection dialogue box, the operator can deselect any tracks, from the tracks listed in the box 33 labelled "Included:" in the dialogue box, which are not required to be present on the distribution CD. By default all tracks on the album will be selected.

Step 6: Select each track and edit the track title, by clicking on the edit button 35 in the track selection dialogue box 30 when the desired track is selected from the list of tracks presented in the box 33 labelled "Included". When the Edit button is clicked, a track

name dialogue box 40 will appear, as shown in Fig. 5. Up to thirteen characters can be entered in the track name dialogue box 40, to identify the track name (e.g. Track1 is the name which has been entered in Fig. 5).

Step 7: Once all tracks are named as required, close the track selection dialogue box 30. The following lines are extracts from a typical track index file trackidx.txt for one album:

Track1 00000000.etx

Track2 00000001.etx

Track3 00000002.etx

The first thirteen characters are the track name which will appear on the LCD display on the headset 5,6. The last twelve characters are the track file name under which the track is stored in the album sub-directory. In the preferred embodiment, the application software automatically replaces the track file names of the tracks stored in the memory of the host computer system (and which are to be copied onto the distribution CD) with a unique 8 digit numeric filename e.g. 00000001.etx, as indicated above. This is necessary because in the preferred embodiment of the player 3, DOS file handling utilities are used to read and stream the track files. The filenames used for storing the track files on the distribution CD therefore need not be related to the actual track title.

Once the Track Selection dialogue box 30 has been closed, all the selected albums and tracks are displayed by the application software in the main configuration window 21 of the main application window 20. Fig. 6 shows an example where two albums are listed in the configuration window 21. As illustrated, the application software has compiled a main configuration file structured so that each album is in a separate sub-directory named using the allocated code number for the album (001 and 002 in this case). Next to the album code name is the album title followed by the directory in which the album sub-directory can be found (C:/Albums in Fig. 6). Each track is listed as a separate sub-directory of the album sub-directory, the track name and file containing the track being listed in the configuration file. As more albums are added by the operator to the configuration file, they will appear in the configuration window 21. The configuration window also includes a box 40 in which the current total CD-ROM image size (i.e. the total number of bytes required to store all the albums of tracks listed in the main configuration file) is displayed.

The main configuration window 21 includes an edit button 42 which can be clicked at any time so as to open the album selection dialogue box 25 to allow the operator to

edit the album data. A delete button 43 is also provided in the main configuration window 21. If the operator highlights an album in the configuration window 21, and then clicks on the delete button, the album selection is deleted from the main configuration file.

Once the main configuration file has been completed with all the desired albums, the operator may save the file to any directory and file name in the host computer system in which the application software is running, by using the File Save and Save As functions available in the Windows operating environment. The main configuration file will automatically be given the extension .BPA and the file can be reopened later for editing and update as required.

To simplify the process of burning a CD-ROM to form the distribution CD, each album of music tracks is copied to a sub-directory of the main root directory of the host computer system, which sub-directory is hereinafter referred to as the "image directory" e.g. the image directory may be named C:/upload. This is illustrated in Fig. 7. The album index file Albumidx.txt and each track index file (stored in the respective album sub-directory) for each album is also copied to the image directory, together with the main configuration file

<configfile.BPA> which is itself first saved in the memory of the host system. The user initiates the building of the upload CD by selecting "File" from the Windows environment, and then "Build". The Build command is a feature of the application software, and when selected carries out automatically the creation of the distribution CD with the above-described contents. Fig.8 is a flow diagram illustrating the above described operations performed by the application software.

In the preferred embodiment, the material to be included in the distribution CD, including all the track files, is encrypted during the distribution CD Build process, before writing on to the distribution CD-ROM. In this manner all the files are encrypted together and can then be "zipped". As above-described, a private/public key encryption algorithm is used, the private key being stored (in firmware) in a memory of at least one of the headsets 5,6 of the listening station. When the CD is uploaded to the player 3, the files will be decrypted on transfer to the hard disk drive memory of the player using the private key retrieved from one of the headsets. (Although it would alternatively be possible to decrypt files only as and when files are requested by a customer for playback, the decryption being carried out just prior to or as part of the file streaming process, this would

incur some delay -about 1 to 2 seconds- which most customers would find unacceptable.)

Using a CD writer, all of the files on the image directory are then copied to ("burned" on to) a CD, the files being copied from the image directory in a manner so as to preserve the same sub-directory and file structure on the CD i.e. the CD should contain albumidx.txt (the album index file) at the root level (c:/albumidx.txt) and album sub-directories c:/001, c:/002 etc. also at the root level, and the albums and tracks being stored according to the structure specified in the main configuration file (.BPA).

Once the contents of the distribution CD have been copied from the CD into the memory of the player 3 of the listening station, it will be appreciated that when a user selects an album on the headset keypad, for example by entering the code 001, the player 3 reads the appropriate sub-directory name from albumidx.txt, which in this case is the sub-directory 001, and then plays the first track of the album by streaming the first track in the sub-directory 001, according to the track order in the trackidx.txt for that album.

A further possible feature of the application software is that it may be designed to also create an output file e.g. CSV (comma separated variable), which produces album and/or track listings when imported into a suitable graphics program. These listings can be used for shop display (e.g. for printing out in paper form or for electronic display on a VDU), the listings displaying to the customer the correct codenames for the various albums/tracks. The output file would be included in the CD image of the distribution CD.

We now turn to consider the features of the music listening station 1 in further detail. Fig. 9 is a block diagram illustrating the music listening station 1. As shown in Fig. 9, the player 3 comprises a central processing unit 50 which is conveniently a microprocessor of the form used in personal computers (PCs); a hard disk drive 52; the CD-ROM drive 9; two decoders 55,56, each comprising a digital signal processor (DSP) chip 57,58 and a Digital-to-Analogue Converter (DAC) 59,60; and two output ports COM 1 and COM 2 on the CPU 50 which are connected to the two decoders 55,56 respectively. The two decoder chips 57,58 are connected to the LPT (i.e. the parallel) port of the CPU 50. Each DAC 59,60 produces an analogue audio output which is input to a respective one of the two headsets 5,6, as shown. In

use, the .etx music files (these are the compressed and encrypted music files) are uploaded (i.e. copied) from a distribution CD 60 inserted in the CD-ROM drive 9, to the hard disk memory of the hard disk drive 52, under control of the CPU 50. Although it would be possible to access the music files directly from the distribution CD it will be appreciated but that by storing the files in the hard disk drive much faster file access is obtainable for streaming the files to the decoders 55,56.

The two DSP decoder chips 57,58 are connected to the CPU via the LPT (parallel) port of the CPU. In this manner it will be appreciated that compressed music files can be streamed simultaneously to the two DSPs, the streamed data being received in byte form by each DSP. Each decoder 55,56 is configured to decode (i.e. decompress) the compressed files it receives, and has an audio output connected to a respective one of the headsets 5,6. In fact, audio communication between each decoder 55,56 and the respective headset 5,6, and digital communication between each said headset and the respective CPU COMs port COM 1, COM 2, (except for volume up/down which is controlled locally, as described later) is by means of a single LAN cable (in Fig.9 this is a CAT 5 cable) 70,71 connected between the decoder 55,56 and said headset 5,6, using an RJ45 connector 60 to connect the LAN cable to

the headset. By using a standard LAN cable which is made up of four twisted pairs of wires, and using one of these four twisted pairs to carry digital communication signals between the CPU 50 and the headset, and the other three twisted pairs to carry power signals and audio analogue signals from the player 3 to the headsets, we eliminate cross talk between the communication and audio signals. Such cross talk, if not eliminated, would cause noise in the audio signal sent to the headphone outputs of the headsets (which would result in poor quality of the music heard by the user via the headphones). Fig. 10 is a sketch illustrating the four pairs of wires in the LAN cable, connected to an RJ45 connector 61. As seen from Fig. 10, the top pair of wires are used as two digital communication rails at ground (GND) and +5 volts, and the lower three pairs of rails are devoted to ground (GND), R_X, T_X, Audio left (L), Audio right (R), and V analogue (analogue power supplied to the headsets) signals, in that order. The T_X and R_X rails only carry electrical signals when any keys on the headset keypads are pressed by the user. (The R_X, T_X signals identify track selections made by a user). In order to avoid cross talk between the R_X, T_X rails and the audio left (L) and right (R) rails feeding the analogue audio to the user headphones 7,8, the audio left and right signals (L,R) to the headphones are muted when any keys on the keypad are

pressed. Fig. 11 is a circuit illustrating how volume control and mute is achieved in the apparatus. Fig. 11 illustrates that from the RJ45 connector 61 of Fig. 10, audio right and left (R,L) outputs are input to a circuit 100 comprising volume control and mute functions. Audio right and left (R,L) outputs from the circuit 100 are fed to the three headphone outputs *a,b,c* of the headset in question, via a low noise audio amplifier 63,64,65 in each headphone output path. Control of the volume control and mute circuit 100 is effected from a microcontroller 150 provided in the respective headset 5,6. Digital signals are received by the microcontroller 150, these signals having been generated by a user having pressed the Volume Up or Volume Down key on the headset keypad. The microcontroller 150 also controls the LCD display 13 on the headset. The R_X, T_X signals are output from an RS232 circuit 155 which is controlled by the microcontroller 150 in the headset, the RX, TX signals being routed to the CPU 50 of the player 3 via the LAN cable connecting the player and the headset, as afore-described.

It will be appreciated from the above and Fig. 11 that volume control of the audio output is therefore effected locally within the headset i.e. signals generated by a user pressing the Volume Up, Volume Down keys in the

keypad of the headset do not need to be sent to the CPU in the player unit 3 in order to effect volume control of the audio output received by the headphones connected to the headsets: instead the volume control is effected within the headset 5,6. This is advantageous in that volume control is therefore effected almost instantaneously as the user presses the Volume Up or Volume Down keys: if volume control signals had to be rooted via the player 3 this would result in a delayed response time between a user pressing the volume control keys and the volume of the audio output actually being changed. Also, if volume control signals had to be rooted via the player 3 this would potentially require increased processing overhead in the player microprocessor, which could limit file streaming capability.

It will also be appreciated that one benefit of connecting the decoders 55,56 to the player unit CPU 50 via the LPT port is that this means that decoders 55,60 could be external to the main player unit 3, if desired, in which case the decoders would be connected to the main player unit and would communicate therewith in a similar manner to, for example, an external printer.

It will be appreciated that the player 3 also includes software for decrypting the encrypted compressed music

files, prior to streaming the decrypted files to the DSP decoders. The decrypted files may be held temporarily in RAM memory provided in the player 3 (not shown). As noted above, the compressed files are encrypted using a public key/private key encryption system. The private key is held securely in firmware stored in a memory in each headset 5,6.

It will further be appreciated that various modifications to the above-described embodiment are possible without departing from the scope of the invention. For example, the apparatus may be designed for use with compressed music files which have been compressed using an alternative compression format to MP3, for example the decoder may be configured to decode files compressed using MSA, liquid audio, Real Player, ePAC (Lucent Technologies), or any other suitable form of data compression for music files.

Furthermore, the decoders could be connected to the player unit 3 via a different type of communication bus, rather than using the LPT port. For example, the decoders could be connected via a PCI interface. This could be conveniently achieved using an add-in PCI card inserted in the player unit 3. Using a PCI interface would enable data to be transferred at 33 megabytes per

second, rather than 2 megabytes per second as when the decoders are connected to an LPT port. For the PCI mode, the decoders would, for example, be mounted on the add-in card which would be connected to the host CPU via a PCI data bus. The desired number of decoders would be mounted on the add-in card.

As another alternative, the decoders could be connected to the host CPU via a USB databus. The most convenient way of implementing this would be to utilise a USB controller between the USB connection to the CPU 50 and the decoders, the USB controller being configured to stream the compressed music files to each decoder as a serial data stream.

Furthermore, instead of using a simple LAN cable between each headset and the player 3, other solutions are possible where more than one connection cable is used therebetween, the number and arrangement of cables being chosen so as to further minimise noise due to coupling between different signals.

Additionally, instead of utilising local volume control as above-described, the system could be designed so that volume control is effected via the player unit 3. This may be desirable in simpler versions of the listening

station which may be designed to stream data to single headphone headsets which will not require multiple amplification. For example, a volume control facility could be provided in the decoder itself, the audio left and right outputs from the decoder then merely passing through a preamplifier to a single set of headphones which could be connected directly to the decoder. Obviously a disadvantage of such a system is that there would be the resulting delay in response time between a user pressing the Volume Up/Volume Down keys and the volume of the audio signal actually being altered, since the Volume Up/Volume Down signals from the headset keypad need to be routed back to the decoder in the player 3. Moreover, if it is desired to have more than one headphone output this type of volume control is not practical. Another possibility, in the above-described embodiment in which the DSP decoders are connected to the LPT port of the CPU 50, would be to provide a microcontroller between each DSP decoder and the CPU, which microcontroller can be used to provide a volume control signal to a DAC via which the digital output from the DSP decoder is routed to the headsets (the DAC could in practice be an integral part of the DSP decoder, as described above). This would still require Volume Up/Volume Down signals generated in the headset to be communicated back to the CPU 50 in the player unit 3,

prior to volume control being effected on the DAC output. It would though have the advantage of no audio power requirements for the headsets 5,6: all audio power requirements would instead be in the player unit 3 containing the decoders, DACs and respective microcontrollers.

It will further be appreciated that the system is designed so that the retail stores can update their listening stations with desired album and track selections by following a relatively easy procedure: the store operator e-mails, to the host computer system running the above-described upload CD creation software, a request for an album/track listing desired for upload to their listening posts. Generally, all listening stations (also referred to herein as "listening posts") for a particular customer (i.e. retail store owner) will have the same content, although several different contents can be maintained for different locations if required, managed by system serial number. The operator of the host computer system will import the customer's request into the system and, via database call procedures, an image of the desired upload CD will be created in a temporary directory of the host computer memory (or secure server memory), following the procedures already described above. The upload image will

take into account the current content on the customer's equipment (from records kept in the host system) and will only select the required new tracks for addition. The listening station will automatically delete all tracks not listed in the active play-list supplied on the upload CD. (Firmware to do this is present in the CPU 50 of the player 3.) When all files are selected, the operator will build the CD-ROM image of the upload CD to a temporary drive directory and then copy this image to a master (upload) CD. The master CD will contain a unique customer ID which will prevent this upload CD being played on any other customer's equipment.

A royalty database will be maintained for all customers (i.e. retail stores), giving details of all tracks on their active play-list and how long they have had these tracks in their playlist. A number of different query reports can be generated by the host computer system for each customer, to facilitate monthly billing for uploaded music tracks/albums. This can easily be extended as required to facilitate digital rights management.

A further feature of the system is that all files stored locally on the listening posts can be deleted by the use of a "null" CD which, upon loading in the CD-ROM drive 9

of the player 3, deletes and removes all files as required.

If desired, as a further security measure, the player may be configured so that the upload CD must be present in the CD-ROM drive 9 of the player at all times during use of the player 3 to play tracks which were copied to the player memory from that upload CD.

A further possibility for additional control of the music files would be to time limit files which are uploaded to the player 3. Thus, licensed content of upload CDs may be set to self-delete after a predetermined time has elapsed. The player and/or headsets would include timer means to time this predetermined period and activate said self-deletion of tracks at the relevant time.

In a further alternative embodiment of the invention, instead of creating an album sub-directory structure as described above, and an album index and separate track indexes for each album, a single directory containing all the music tracks individually may be used. In such an embodiment each track would have its own codename, for example a five digit codename consisting of the 3 digit album code and a 2 digit track code e.g. 001001 for track 1 of album 1. The track filename could, for example, then

be in the form of 001001.etx. The application software would be designed to compile a single track index comprising a list of the allocated track codenames and the corresponding filenames containing the respective tracks, as well as corresponding full track and album names for display on the headset when each track is playing (if desired). The configuration file would comprise the list of all track filenames in the single directory. This embodiment may be more amenable to database searching.

It will be appreciated that the above-described system could be extended to more than two listening channels (i.e. more than two headsets 5,6). The system could be expanded to multiple channels through the use of a higher bandwidth bus e.g. a PCI or USB bus. PCI and USB versions will now be described.

PCI Bus version

A multi channel playback system can be developed to utilise a PCI bus as the communications and data bus. Fig.12 illustrates a typical block diagram of such a system. Typically when utilising a PCI bus, it is necessary to employ a PCI controller IC 150 available from a number of suppliers. This provides an interface from the PCI bus to a local data/address bus to which

other components can be added, such as RAM 160 and a microcontroller 170. In the system shown, in each channel (Decoder 1,Decoder2,…) a micro-controller (MCU) 170 provides the function of advising the PCI controller 150 of the status of the channel i.e. whether a request has been made from the headset 5 for a track. The headset communicates with the MCU via a serial interface 180 (RS232 or other variant). On receiving the headset request, the MCU passes a response to the host PC system (i.e.CPU in the player 3) via the PCI controller. The host will then deliver the requested (compressed) track to the local RAM 160 from which the MCU delivers the track to the headset via the DSP and DAC 190. In addition, the host will transfer display information to a preset address on the local RAM, which will be retrieved by the MCU 170 for transmission to the headset.

Utilising local memory on each channel will allow many channels to be provided without limiting the performance of the system and considerably simplify the software on the host system, as this will now only need to maintain a record of status requests from the headsets. However, it is possible that in some cases it may be possible to omit the local memory and stream compressed music files directly to the MCU/Decoder, provided the bandwidth of the PCI bus can provide both file streaming and maintain

headset communications as an overhead. This scheme may be possible for up to 8 channels. The benefit of adding local RAM simplifies the control software and scheduling and is not too cost prohibitive.

Multiple channels can be added to the PCI bus, with each channel being assigned to a different address for communications and local RAM. Expansion of the number of channels could be catered for by either creating a large PCB with all the channel circuits or, alternatively, adding multiple PCI cards with around 4-8 channels per card as determined by PCB layout constraints.

USB version

An alternative method of adding multiple channels would be to utilise a USB bus to communicate with an external decoder module (Decoder 1'). A typical configuration of this design would utilise a USB controller interface IC 210, preferably with an embedded microcontroller. These are now readily available from a number of manufacturers.

The USB interface allows data to be transferred from the host PC system (the player CPU), including both music files being downloaded to the decoder module (Decoder 1') and headset service requests being transmitted from the headset 5 via the decoder module. The device would work

in a similar scheme to that described for the PCI version but utilising the slower PC USB bus as the physical communications layer.

Additional channels could be added by adding a USB hub and multiple decoders (Decoder 1',Decoder 2',...) as shown in Fig.13. It is also possible that multiple decoders could be serviced from a single USB controller chip (e.g. 2-4) which would reduce the requirements of the USB hub accordingly.

As an alternative to, or in addition to, the user keypads 10,11 on the headsets 5,6, a bar code scanning device could be provided for enabling a customer to scan in the barcode for a desired album/track, from a preprovided list of barcodes (indexed to album/track names). The scanner could be a laser or CCD-based scanner, for example, and may be connected to the microcontroller 150 of a respective headset 5,6 via a serial interface. The index files (e.g. album and track index files) would incorporate the barcode associated with each track.

Although the above-described music listening stations are designed primarily to be stand-alone stations, they could alternatively be used in a networked system. In such an arrangement, a plurality of the music listening stations

may be networked on to a control server system. Fig.14 illustrates schematically such a networked system, incorporating three of the above-described player units 3, 3',3'' each with two headsets 5,6,5',6',5'',6''. Each player 3 incorporates a network interface card (NIC) which communicates with the control server system 300 via a control hub 310 to which other player units could also be connected. Such a system is thus more suited to traditional music retailers requiring, for example, upwards of five listening posts in a single store. New CD uploads may be distributed to the control server system either via a physical distribution CD as afore-described (the control server system would have a CD-ROM drive for this purpose) or via a download from the internet 320 (via a service provider 330 servicing the control server system) or direct dial up to a remote database. All uploaded/downloaded music files will be held in a main database memory 340 accessible to the control server system.

Claims:

1. A music listening system comprising music index compilation means for compiling index means for a library of music tracks for storage together with said library of music tracks on a distributable music storage means for use with the listening system; and a music listening station comprising:

memory means for storing a library of music tracks;

loading means for loading said library of music tracks and said index means from the distributable music storage means into said memory means;

selection means for enabling at least one user to select from said index means stored in said memory means a particular music track which he/she wishes to listen to; and playback means for enabling at least one user to listen to a said music track which he/she selected.

2. A music listening system as claimed in Claim 1 wherein the selection means comprises microprocessor means for controlling access to the music tracks

stored in said memory means, and user input means via which a user may select desired tracks.

3. A music listening system as claimed in Claim 2 wherein the index means comprises a list of albums, each album comprising one or more music tracks, and for each album a sub-list of the tracks thereof, and the user input means is configured to enable a user to select a track by first selecting, from the album list, the album containing the track and then selecting the said track from the respective track sub-list for that album.

4. A music listening system as claimed in Claim 2 or Claim 3 wherein the user input means comprises first user input means for enabling a first user to select from said library of music tracks stored in said memory means a particular music track which he/she wishes to listen to, and second user input means for enabling a second user to select from said library of music tracks stored in said memory means a particular music track which he/she wishes to listen to.

5. A music listening system as claimed in Claims 2 to 4 wherein one or each said user input means is in the

form of an electronic keypad means which is in communication with the microprocessor means, for enabling a user to select a desired music track.

6. A music listening system as claimed in Claims 2 to 4 wherein one or each said user input means is in the form of bar code scanning means for enabling a user to select music by scanning a CD barcode, and the system further includes a database or look-up table from which music corresponding to the scanned barcode is identified and accessed by the microprocessor means.

7. A music listening system as claimed in any one of the preceding Claims wherein the playback means comprises means for streaming music tracks simultaneously to first and second headphone output means provided in the listening station.

8. A music listening system as claimed in any one of the preceding Claims wherein the music tracks are stored on said distributable music storage means, and in said memory means of the music listening station, in compressed form.

9. A music listening system as claimed in Claim 8 wherein the playback means further includes a plurality of decoder means for simultaneously decoding a plurality of streams of the compressed music data respectively.

10. A music listening system as claimed in Claims 8 or 9 wherein the compressed music is encrypted prior to storage on said music storage means, and the playback means further includes decryption means for decrypting the encrypted data.

11. A music listening system as claimed in Claim 10 wherein the decoder means may incorporate said decryption means.

12. A music listening system as claimed in any one of Claims 1 to 7 wherein a multistage process is employed whereby encrypted music files are decrypted to an intermediate compressed digital audio format and then decompressed in a hardware based decompression chip forming a decoder means.

13. A music listening system as claimed in Claim 9 wherein said plurality of decoder means are connected to a parallel output port of said

microprocessor means, whereby each said decoder means receives a serial stream of compressed music data from said playback means.

14. A music listening system as claimed in Claim 9 wherein said plurality of decoder means is connected to said microprocessor means via another type of communication bus, but in such cases data serialising means is provided for supplying the compressed music data to each decoder means in serial.

15. A music listening system as claimed in any one of Claims 2 to 14, wherein the memory means, the loading means and the microprocessor means are provided together in a single unit and each said user input means which is provided comprises a separate module which is connected to said unit.

16. A music listening system as claimed in any one of Claims 4 to 14 wherein said first and second headphone output means are provided in said first and second user input means respectively, and are formed and arranged for connection to respective user headphone means for enabling first and second

users respectively to listen to music streamed to said headphone output means.

17. A music listening system as claimed in any one of Claims 4 to 16 wherein each said user input means is connected to said unit via a single electrical communication cable via which audio signals are sent from said unit to the respective headphone output means provided in said user input means, and via which communication signals are sent from said user input means to said unit.

18. A music listening system as claimed in Claim 17 wherein the communication signals include signals representing music tracks selected by a user.

19. A music listening system as claimed in Claim 17 wherein the single electrical communication cable is a standard LAN cable, that is having four twisted pairs of wires.

20. A music listening system as claimed in Claim 17 to 19 wherein all digital communication signals sent between the user input means and said unit of the listening station are sent via one twisted pair of wires in the LAN cable, while all analogue audio

signals are sent to the headphone output means in the user input means via different twisted pairs in the LAN cable.

21. A music listening system as claimed in Claims 17 to 20 wherein to further reduce electrical cross talk separate ground return lines are provided for the analogue and digital signal paths between the listening station and the user input means.

22. A music listening system as claimed in Claim 1 wherein the music index compilation means comprises computer program means, for use in a computer system, the computer program means comprising computer readable program code for compiling index means for use in accessing a plurality of music tracks to be stored in the memory means of the listening station, the index means comprising a list of allocated codenames and for each said codename corresponding access information for accessing at least one file containing a said music track.

23. A music listening system as claimed in Claim 22 wherein the index means comprises a list of allocated codenames associated with respective music

tracks and, for each said codename, a filename of a file containing the respective music track.

24. A music listening system as claimed in Claim 22 or 23 wherein the computer readable program code may comprise code for compiling an index of music tracks to be stored in a directory of the memory means of the listening station, said index comprising a list of allocated code names for respective music tracks and for each said allocated code name a corresponding filename of a file which will contain the respective music, in use of the listening station.

25. A music listening system as claimed in Claim 22 wherein the computer readable program code comprises code for:

a) compiling an index of albums of music tracks to be stored in a directory of the memory means of the listening station, said album index comprising a list of allocated album code names and for each said allocated code name a corresponding sub-directory name for accessing a sub-directory of said directory of said memory means which sub-directory will contain

the album having the said allocated code name, in use of the listening station;

b) compiling an index of tracks for each said album to be stored in the memory means, said track index comprising a list of track names and for each said track name a corresponding file name of a file which will be stored in the sub-directory which contains the album including the track having the said track name; and

c) compiling a configuration file comprising a structured list of all said album sub-directories listed according to sub-directory name, and of all said files named in the track indexes, each said file being listed in the respective album sub-directory.

26. A music listening system as claimed in Claim 25 wherein the computer readable program code further includes code means for enabling a user to interact with said computer program means so as to allow the user to control the order in which albums and/or tracks are listed in one or more of: the album index, the track indexes, and the configuration file, and/or to choose the sub-directory names

and/or file names under which said albums and tracks are stored.

27. A music listening system as claimed in Claim 25 and 26 wherein the computer readable program code further includes code for compiling a file representing a CD-ROM image of a distribution CD which is to be created, said CD-ROM image comprising a copy of the index means, a copy of all the files containing said music tracks, and a copy of the configuration file (where provided).

28. A music listening system as claimed in Claim 27, wherein the file is used in the creation of the distributable music storage means for use with the listening system.

29. A music listening system as claimed in any one of the preceding Claims wherein the loading means of a said listening station is adapted to load said music tracks into the memory means of the listening station, from said distributable music storage means, so that they are stored in said memory means according to the file structure specified in the configuration file.

30. A music listening system used in a network system, for example a network system incorporating more than one said listening station, all the listening stations being controlled by control server means forming part of the network system.

31. A music listening system as claimed in Claim 30 wherein the control server means is adapted to receive music files from a remote database with which the control server means is in communication, for example as a download from the internet, and to supply the received music files to one or more of the listening stations networked thereto.

32. Music index compilation means for compiling index means for a library of music tracks for storage, together with said library of music tracks, on a distributable music storage means, said compilation means comprising computer program product means, for use in computer system, to compile said index means, the index means comprising a list of allocated codenames and for each said codename corresponding access information for accessing at least one file containing a said music track.

33. A music listening system as claimed in Claim 32 wherein the computer program product means comprises computer readable code means for:

a) compiling an index of albums of music tracks to be stored in a directory of a memory means, said album index comprising a list of allocated album code names and for each said allocated code name a corresponding sub-directory name for accessing a sub-directory of said directory of the memory means which sub-directory will contain the album having the said allocated code name;

b) compiling an index of tracks for each said album to be stored in the memory means, said track index comprising a list of track names and for each said track name a corresponding file name of a file stored in the sub-directory which contains the album including the track having the said track name; and

c) compiling a configuration file comprising a structured list of all said album sub-directories listed according to sub-directory name, and of all said files named in the track indexes, each said file name being listed in the respective album sub-directory.

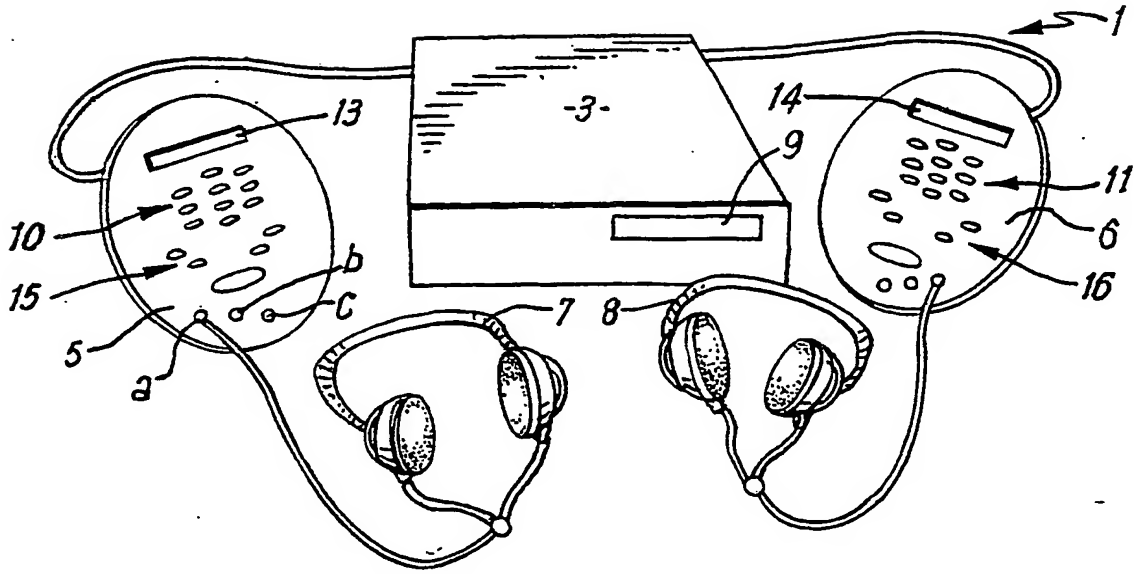


FIG.1

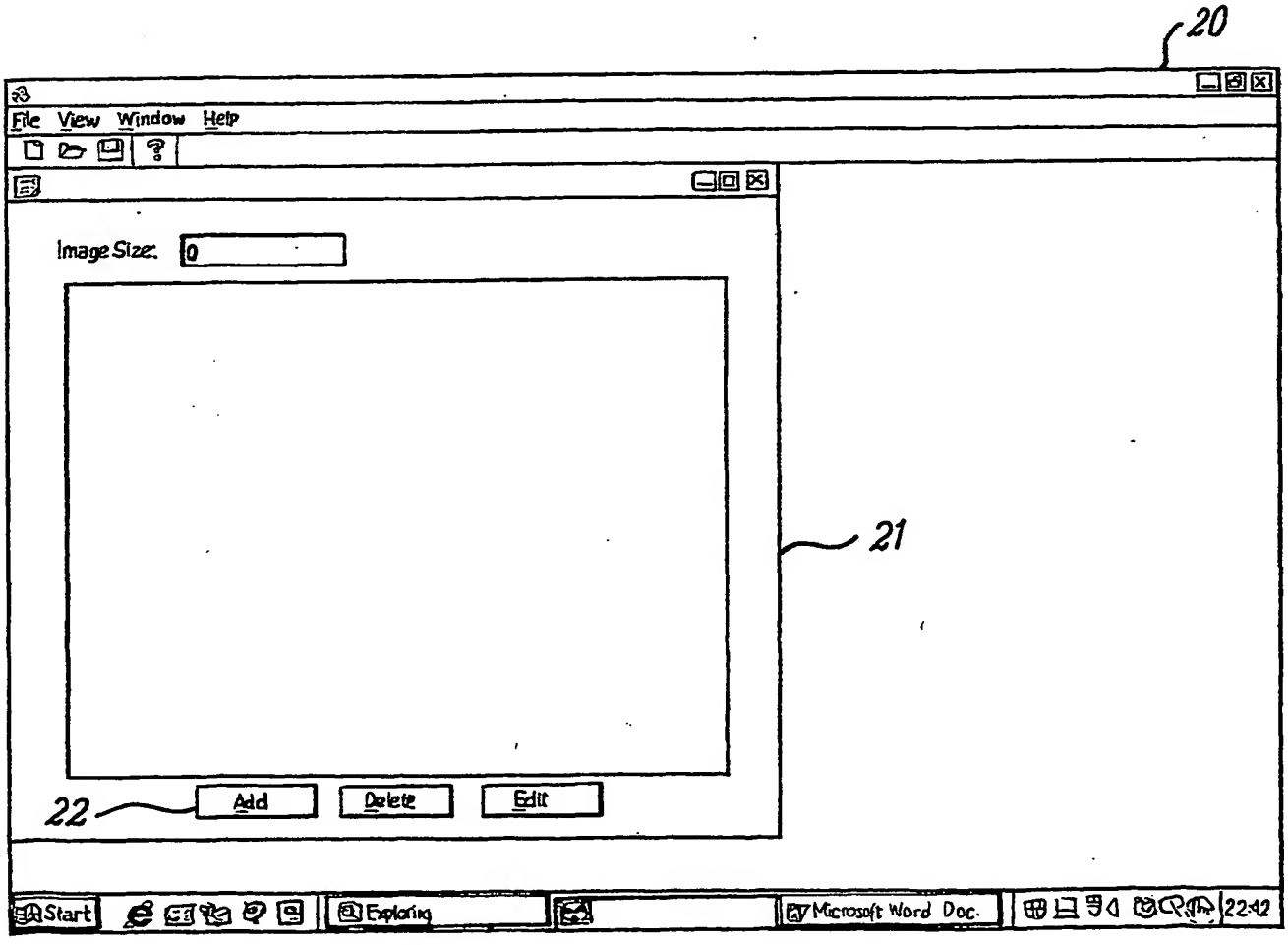


FIG.2

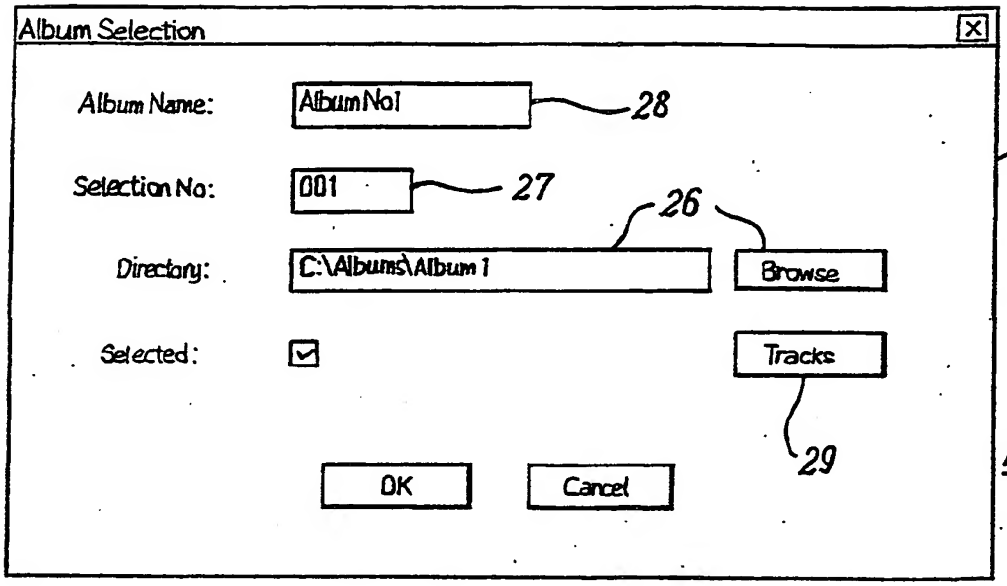


FIG. 3

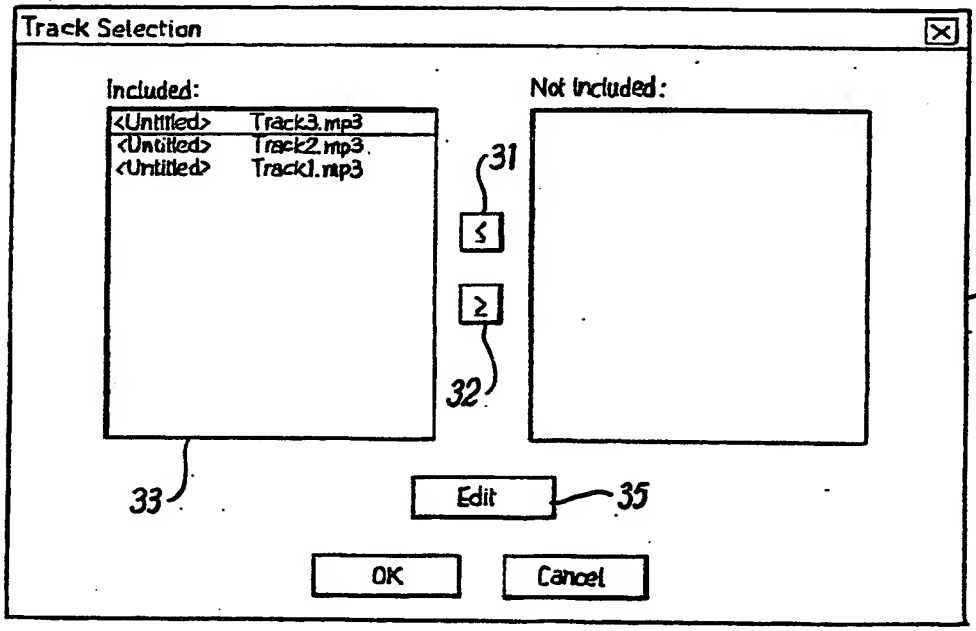


FIG. 4

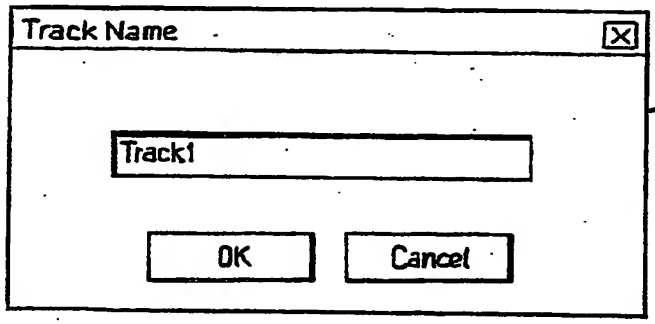


FIG. 5

FIG. 6

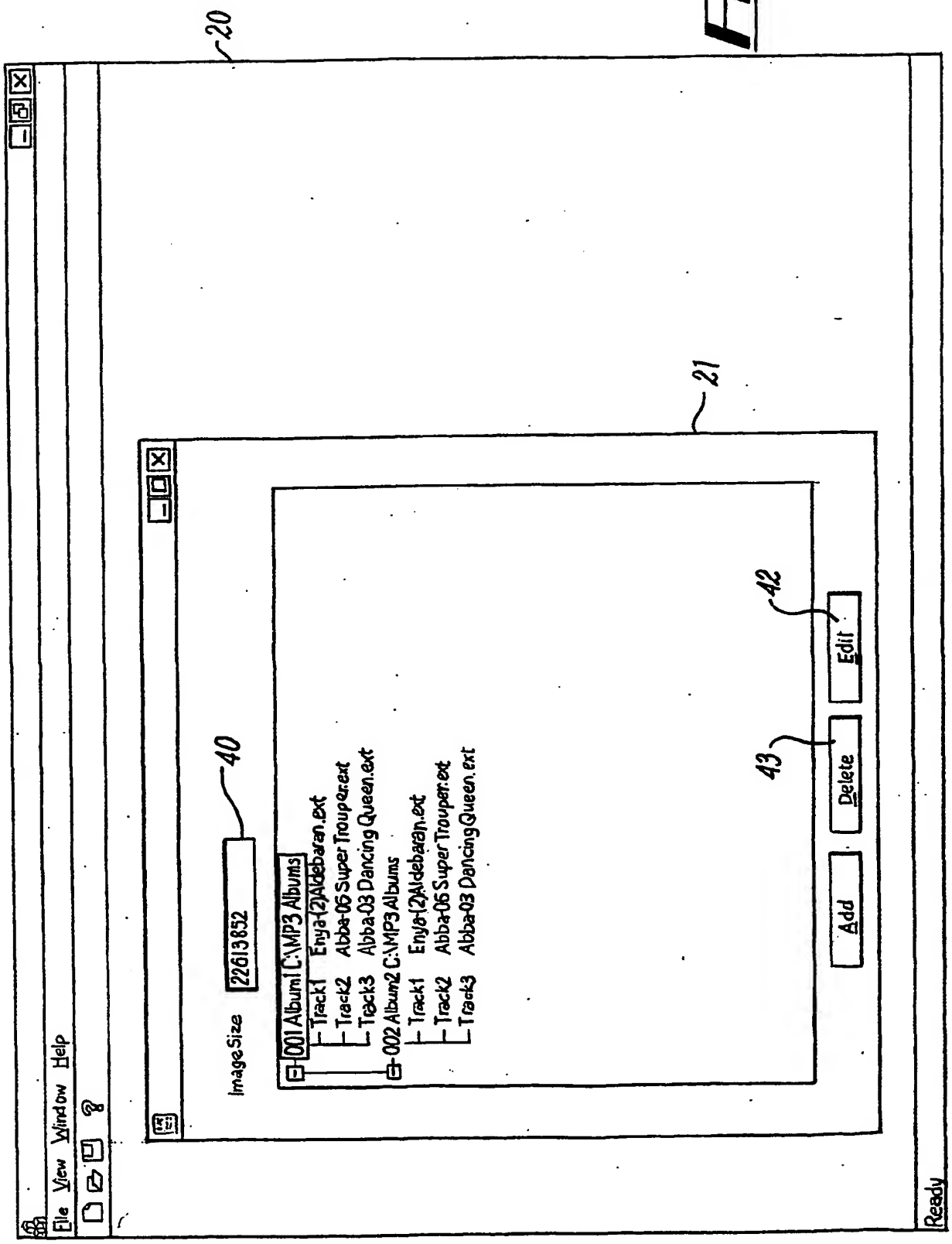
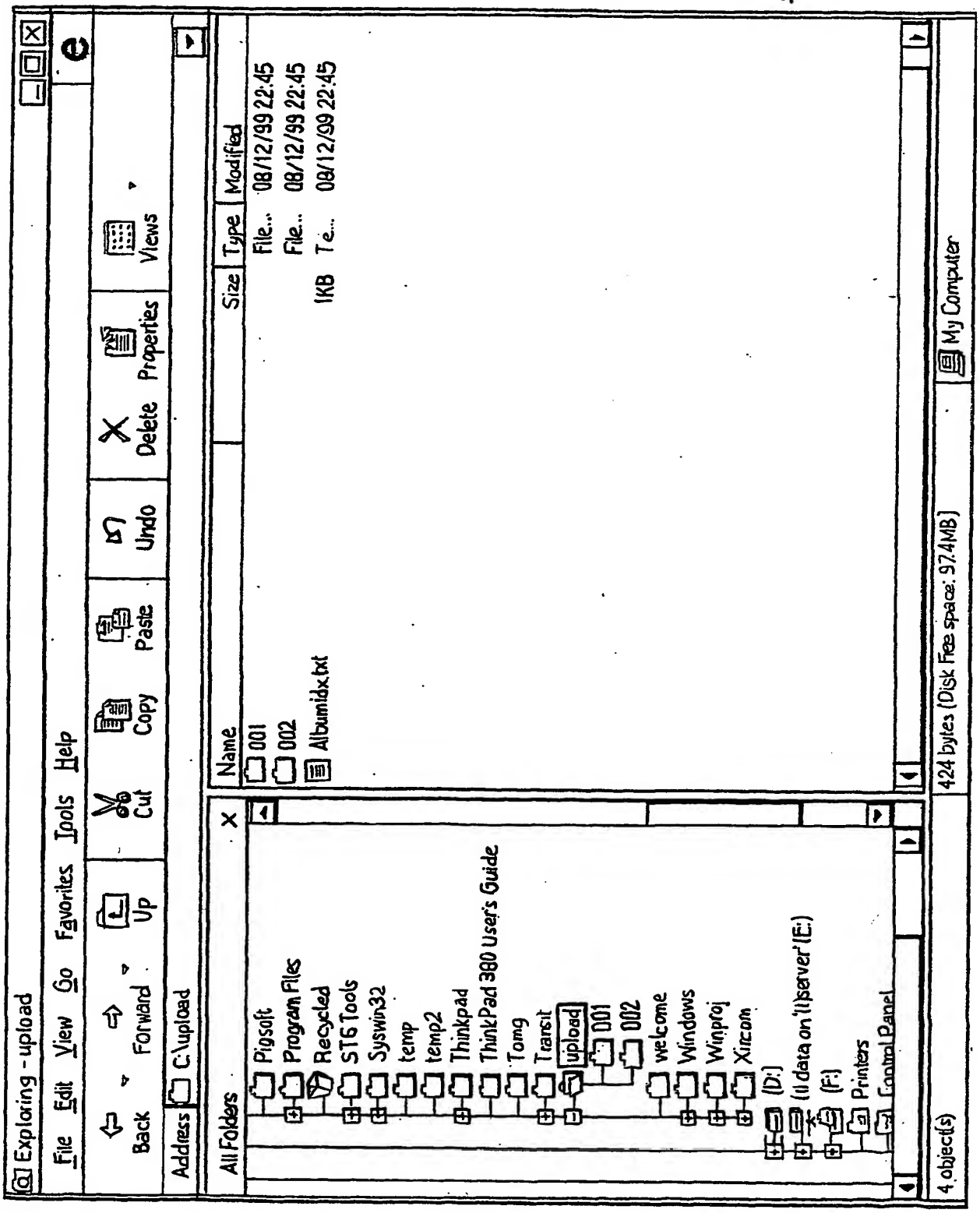


FIG. 2



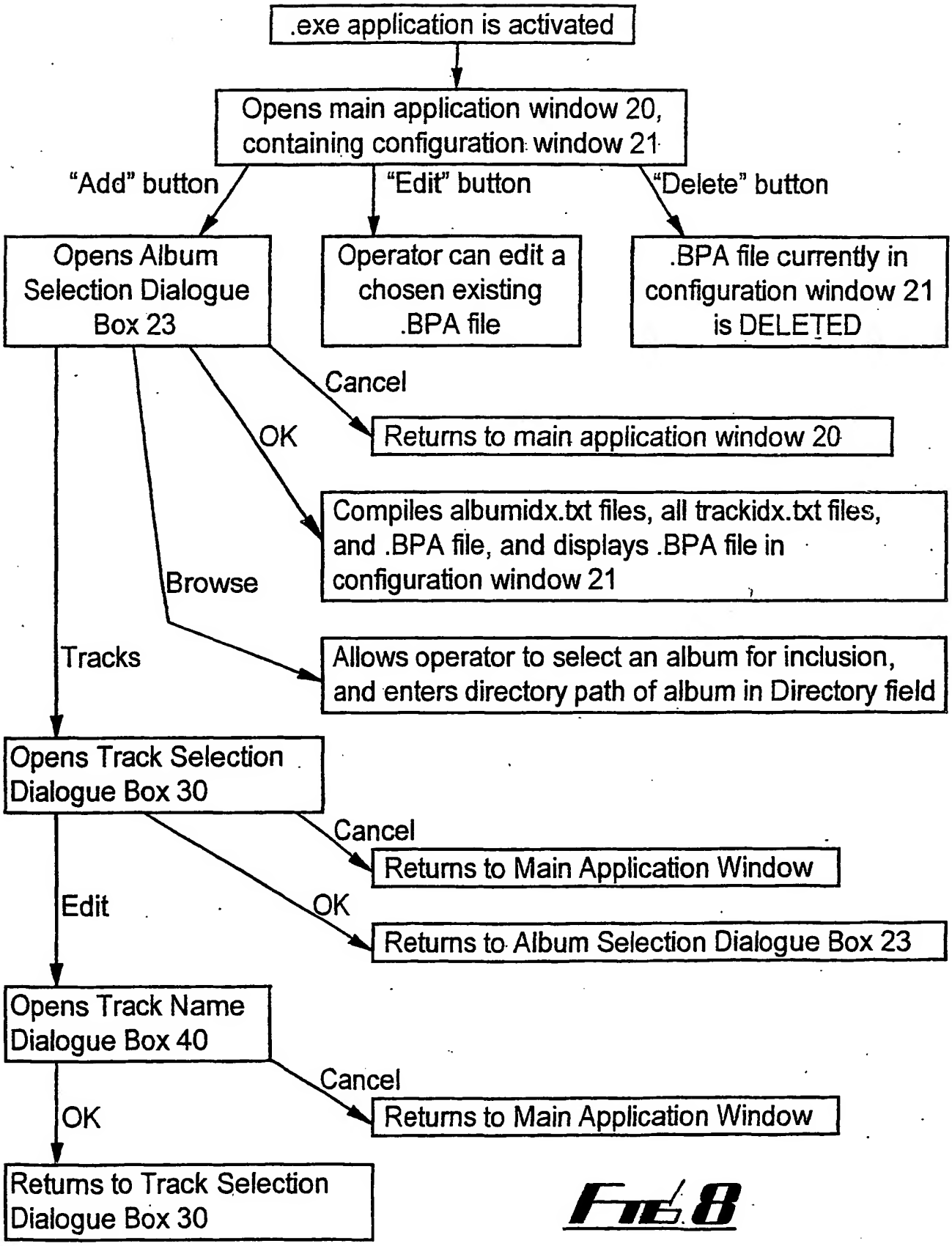


FIG 8

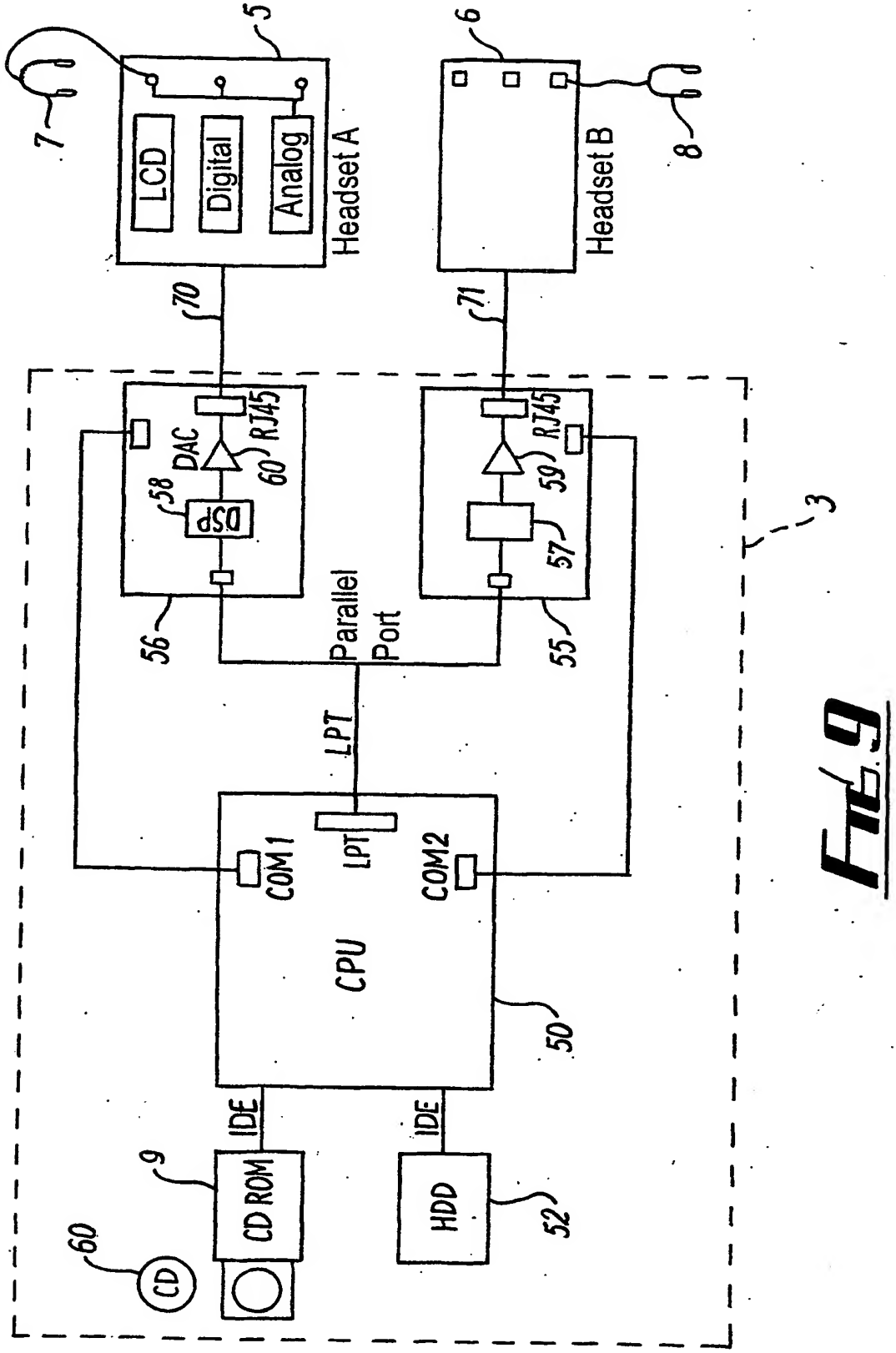


Fig 9

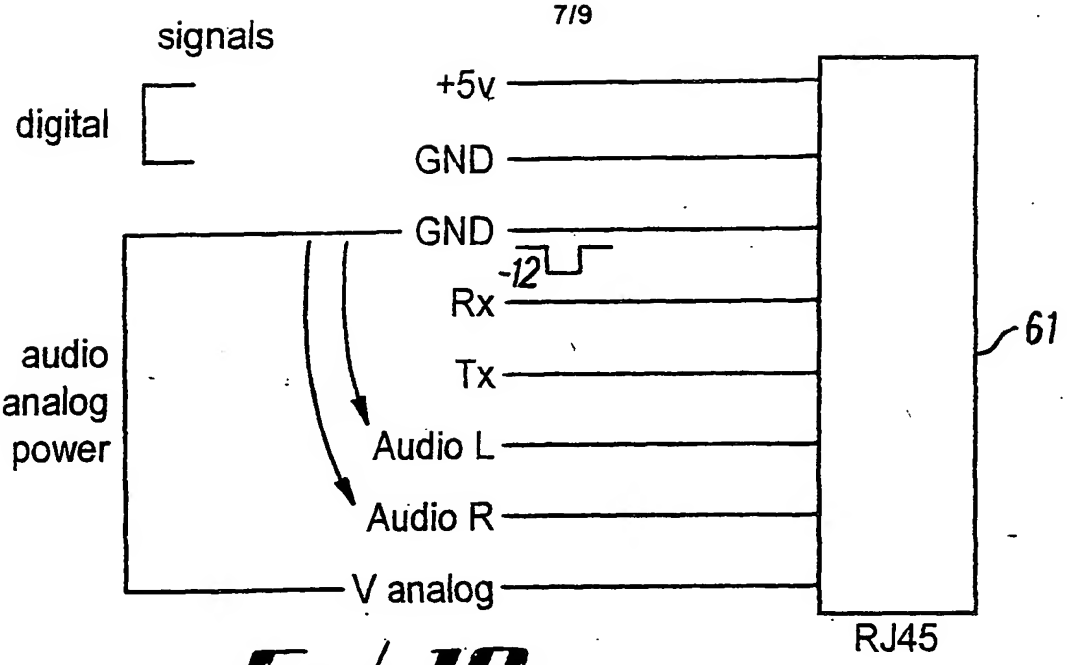


FIG. 10

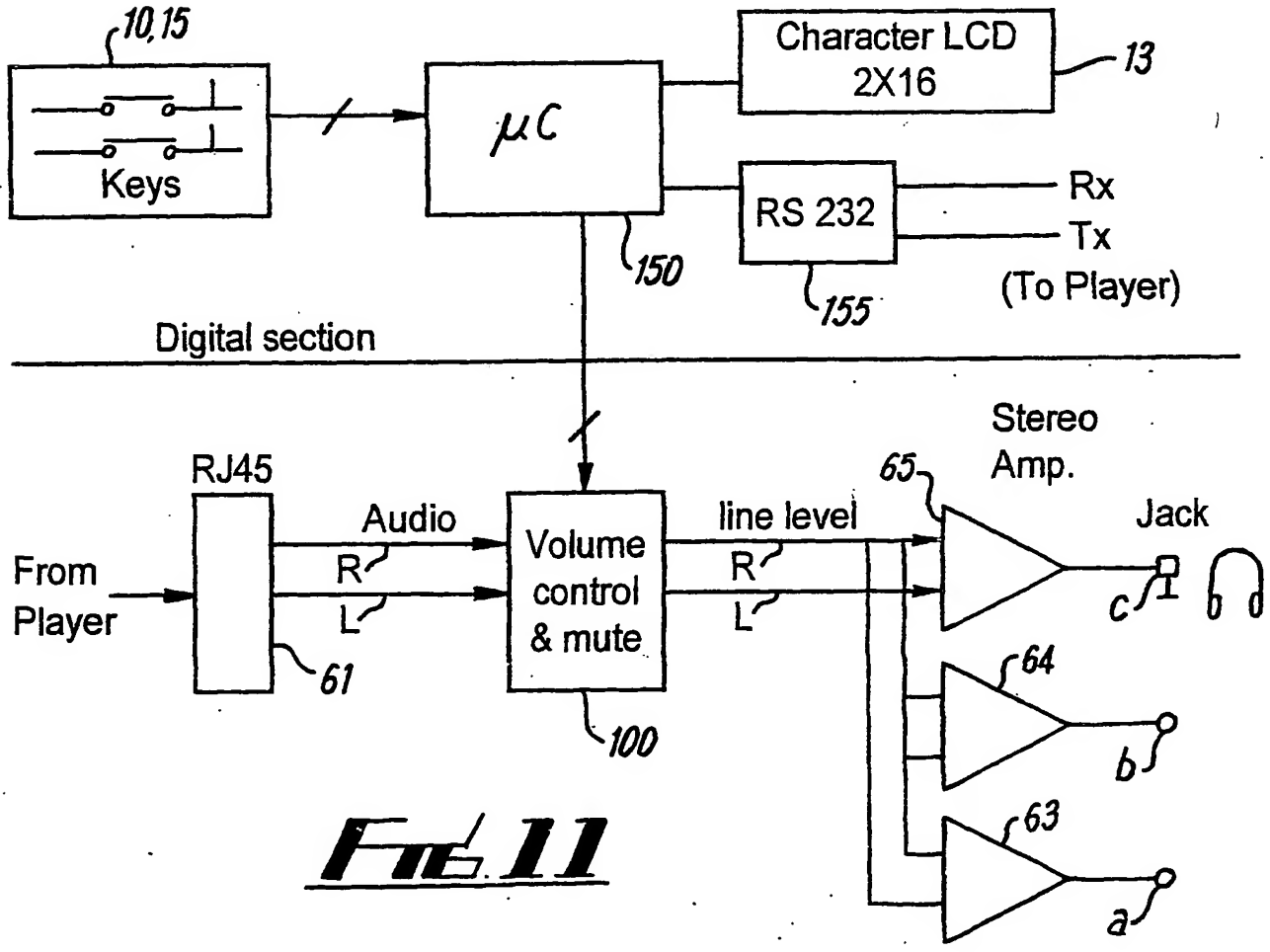


FIG. 11

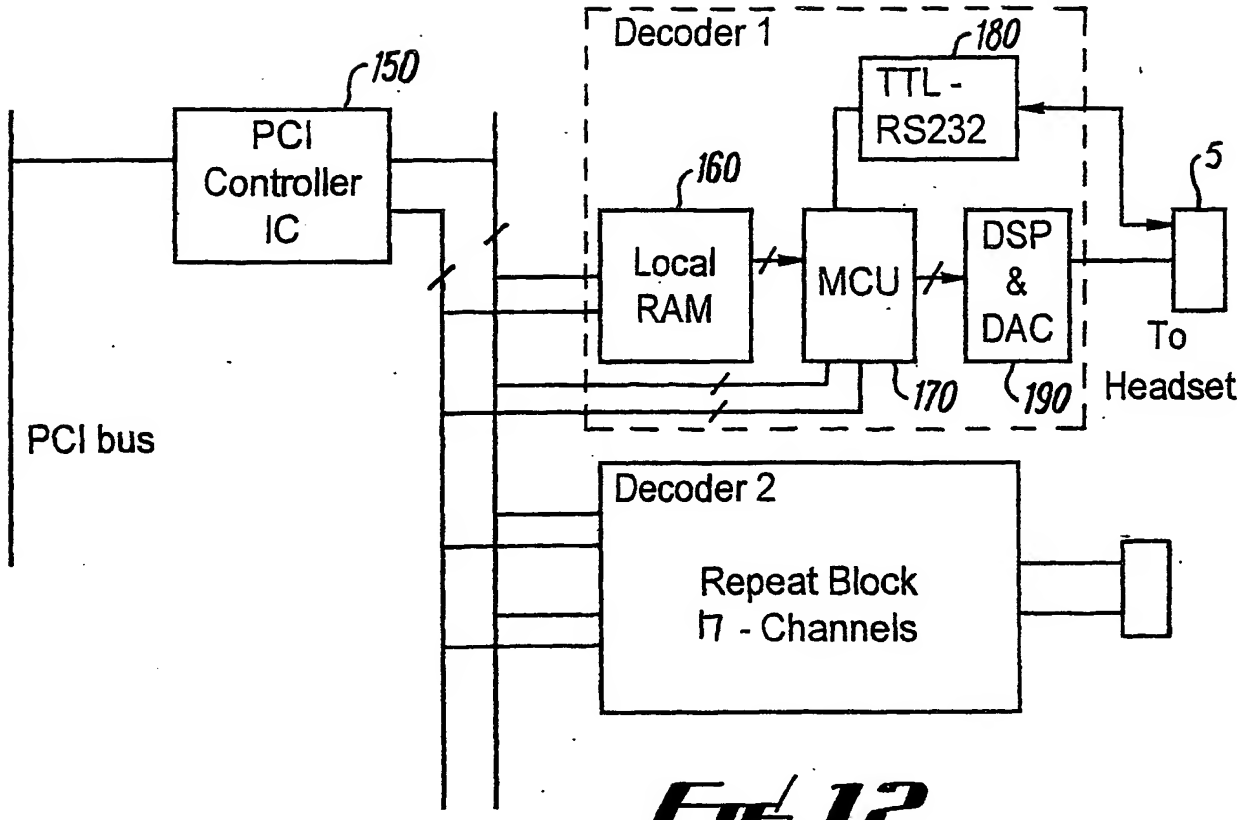

Decoder 1
180
TTL - RS232
150
PCI Controller IC
160
Local RAM
MCU
DSP & DAC
5
To Headset
PCI bus
170
190
Decoder 2
Repeat Block
17 - Channels

FIG. 12

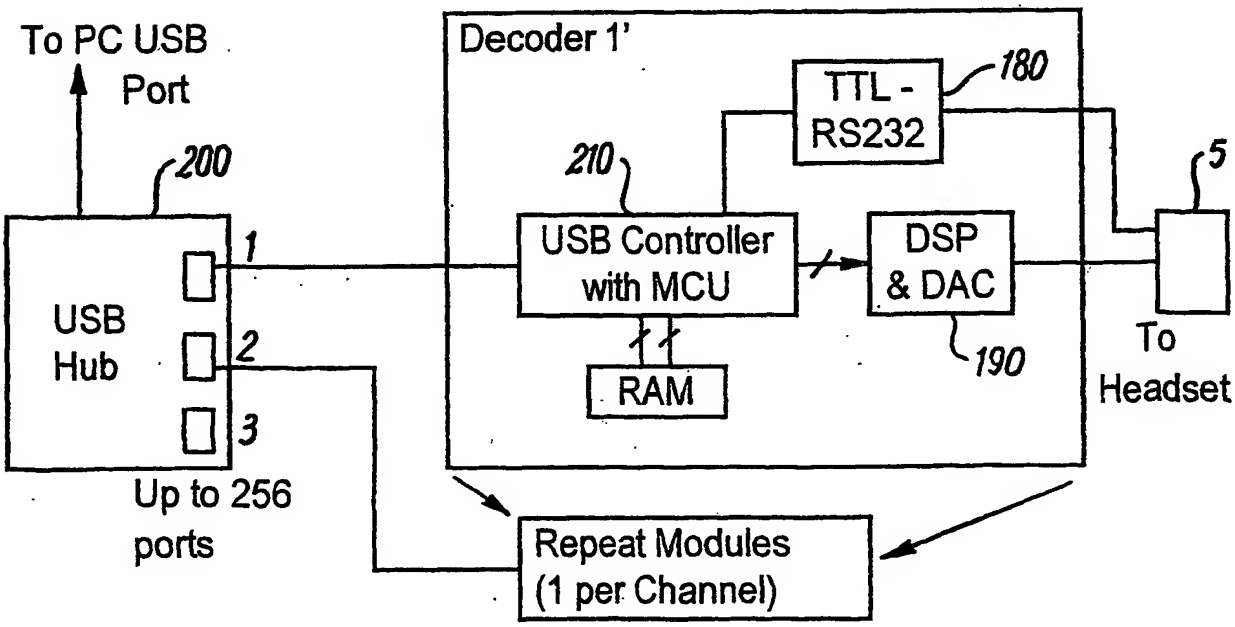

To PC USB Port
Decoder 1'
TTL - RS232
180
200
210
5
USB Hub
1
2
3
USB Controller with MCU
DSP & DAC
190
To Headset
RAM
Up to 256 ports
Repeat Modules (1 per Channel)

FIG. 13

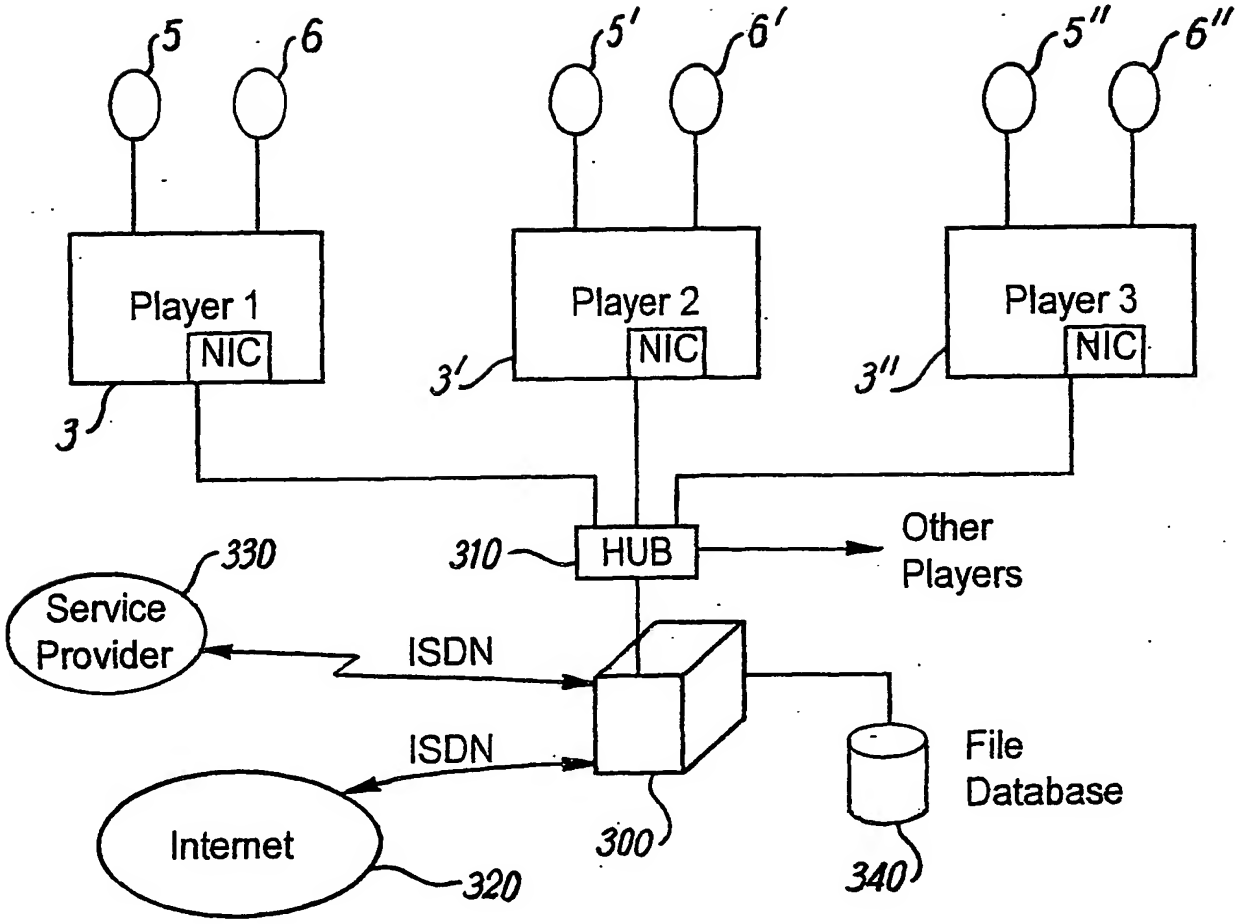


FIG. 14

INTERNATIONAL SEARCH REPORT

Interna[illegible]l Application No
PCT/GB 01/03264

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 G11B27/00 G11B27/031 G07F17/16 H04H1/02

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 G11B G07F H04H G06F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, WPI Data, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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X	US 5 963 916 A (KAPLAN JOSHUA D) 5 October 1999 (1999-10-05) the whole document	1-5,7-9, 16,22-33
X	DE 197 57 129 A (KNELLER STEFAN) 24 June 1999 (1999-06-24) the whole document	1-3,5, 15,22, 23,29,30
X	FR 2 739 715 A (VINOT ERIC) 11 April 1997 (1997-04-11) the whole document	1-9, 15-18, 29-33

-/--

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
15 October 2001	23/10/2001

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Daalmans, F

INTERNATIONAL SEARCH REPORT

Internal Application No
PCT/GB 01/03264

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

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INTERNATIONAL SEARCH REPORT

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Intern: al Application No
PCT/GB 01/03264

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